

- (b) The requirements of Section 14, wherever the actions that could be transmitted by the superstructure at the top of the foundations are equal or larger than those which would result from the application of lateral earthquake loading to the superstructure corresponding with $SM = 1.6$.

3.5.12.5 *Rocking foundations.* When special studies are carried out to the satisfaction of the Engineer, structural walls may be assumed to limit the seismic loads induced in the structure by rocking with their foundations, provided that:

- (a) The vertical design loads on the foundations are determined from factored gravity loads together with overstrength contributions of adjacent slabs, beams and other elements which may be yielding during the rocking of the wall system, and having regard to all accelerations induced in the superstructure during rocking
- (b) The lateral design load acting simultaneously with the vertical forces, in accordance with 3.5.12.4 (a), are determined from special studies.

3.5.12.6 *Lateral forces on retaining walls and piles.* Particular attention shall be given to forces that might develop against retaining walls and piles during earthquakes.

3.5.12.7 *Uplift forces.* Uplift forces that may act on foundation pads during earthquakes, shall be considered to ensure that, when necessary, adequate flexural tension reinforcement is provided in the top of isolated footing pads or in other localities of continuous or combined footings or rafts, where under gravity load compression stresses would prevail. Such reinforcement shall not be less than 0.001 times the gross sectional area of such a pad.

3.5.13 *Structures incorporating mechanical energy dissipating devices.* The design of structures incorporating flexible mountings and mechanical energy dissipating devices is acceptable provided that the following criteria are satisfied:

- (a) The performance of the devices used is substantiated by tests
- (b) Proper studies are made towards the selection of suitable design earthquakes for the structure
- (c) The degree of protection against yielding of the structural members is at least as great as that implied in this Code relating to the conventional seismic design approach without energy dissipating devices
- (d) The structure is detailed to deform in a controlled manner in the event of an earthquake greater than the design earthquake.

3.5.14 *Secondary structural elements*

3.5.14.1 Secondary elements are those which do not form part of the primary seismic force resisting system, or

are assumed not to form such a part and are therefore not necessary for the survival of the building as a whole under seismically induced lateral loading, but which are subjected to loads due to accelerations transmitted to them, or due to deformations of the structure as a whole. These are classified as follows:

- (a) Elements of Group 1 are those which are subjected to inertia loading but which, by virtue of their detailed separations, are not subjected to loading induced by the deformation of the supporting primary elements or secondary elements of Group 2
- (b) Elements of Group 2 are those which are not detailed for separation, and are therefore subjected to both inertia loadings, as for Group 1, and to loadings induced by the deformation of the primary elements.

3.5.14.2 Group 1 elements shall be detailed for separation to accommodate deformations $\nu\Delta$ and Δ_p . Such separation shall allow adequate tolerances in the construction of the element and adjacent elements, and, where appropriate, allow for deformation due to other loading conditions such as gravity loading. For elements of Group 1:

- (a) Loading E_p used in the design shall be that specified in NZS 4203
- (b) Analysis may be by any rational method
- (c) Detailing shall be such as to allow ductile behaviour and in accordance with the assumptions made in the analysis. Fixings for precast units shall be designed and detailed in accordance with 3.5.15.

3.5.14.3 Group 2 elements shall be detailed to allow ductile behaviour and in accordance with the assumptions made in the analysis. For elements of Group 2:

- (a) Additional seismic requirements of this Code need not be satisfied when the design loadings are derived from the imposed deformations $\nu\Delta$, specified in NZS 4203, and the assumptions of elastic behaviour
- (b) Additional seismic requirements of this Code shall be met when plastic behaviour is assumed at levels of deformation below $\nu\Delta$
- (c) Inertia loading E_p shall be that specified by NZS 4203
- (d) Loadings induced by the deformation of the primary elements shall be those arising from the level of deformation $\nu\Delta$, specified in NZS 4203 having due regard to the pattern and likely simultaneity of deformation
- (e) Analysis may be by any rational method, in accordance with the principles of elastic or plastic theory, or both. Elastic theory shall be used to at least the level of deformation corresponding to and compatible with one-quarter of the amplified deformation, $\nu\Delta$, of the primary elements, as specified in NZS 4203